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A PANDORA MOTH INFESTATION IN LODGEPOLE PINE
IN WESTERN COLORADO

By

J. A. Beal, Entomologist

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Forest Insect Laboratory
Fort Collins, Colorado
March 16, 1938

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A PANDORA MOTH INFESTATION IN LODGEPOLE PINE
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About the middle of August 1937 a number of lodgepole pine areas on the Arapaho National Forest showed up as gray-brownish areas and had the general appearance of having been burned over the previous year. Upon closer examination it was found that the damage was caused by a rather general outbreak of the pandora moth (Coloradia pandora Blake). Although this insect was first described from Pike's Peak, Colorado, it is chiefly known as a pest of ponderosa pine in southern Oregon and northern California * but is also listed as occasionally attacking Jeffrey pine and lodgepole pine. Relative to the outbreaks in the Pacific States, Patterson* says, "The attacks on lodgepole pine appear to be purely incidental, as this species suffers only when it occurs in stands of yellow pine." In Colorado however we find it assuming an important role as an enemy of lodgepole pine since the outbreaks here occur in pure stands of this species.

* Patterson, J.E. "The Pandora Moth, a Periodic Pest of Western Pine Forests." U.S.D.A.Tech. Bul. No. 137, Oct. 1929.

Description

The eggs of the pandora moth are globular in shape, slightly compressed on two opposite sides. They vary in size, but average 2 mm. wide and 2.5 mm long. In color they are pale, semitransparent green. They are deposited in clusters.

The newly hatched larvae are about 6 mm. long. They are black or brownish and are covered with short, dark hairs. The head is broad, black, and shiny. The body tapers toward the rear. Mature larvae are 2-1/4 to 2-3/4 inches long and are yellowish-green with stiff spines on the body.

The pupae (Fig. 1) are dark chocolate-brown and are about an inch long and a half inch wide. The external characters of the moths can be plainly seen on the pupae.

The adults are brownish-gray with a purplish hue. They have a wing spread of 2-3/4 to 3-1/2 inches. The body length is from 1 to 1-1/2 inches. The antennae of the males are feather-like, that of the female more slender, but in both sexes the antennae are serrated on two sides.

Life Cycle

Adults. The life cycle of the pandora moth covers a period of two years. In the case of the present epidemic on the Arapaho National Forest the adult moths will appear during the summer of 1938, probably during the month of July. Shortly after emerging from the pupal cases in the soil mating and egg laying take place. The moths are strong fliers and are diurnal in their habits.

Eggs. Eggs are laid during July and August in clusters of varying size on the needles and bark of trees and even on bushes. They hatch in about ten days or two weeks depending on the prevailing temperatures.

Larvae. The young larvae emerge during late August and early September, crawl to the tips of the branches, and begin feeding in clusters on the needles of the current year's growth. They continue feeding throughout the summer and fall months, becoming an inch or more long the first summer. As winter comes on they go into hibernation in clusters on the branches and are fairly dormant during the winter. They usually become active again the following April and feeding is resumed the second summer as individual larvae. They continue feeding until late July or early August when they migrate to the ground in preparation for pupation the second winter, having spent the first as small larvae on the branches.

Pupae. The prepupal larvae burrow into the ground in selected loose mineral soil where pupation takes place in early August. The pupae remain in the ground until the following summer when they emerge as adults about July. Thus two full years are required for the completion of a single life cycle.

Nature of Injury

There are two types of damage which may result from the feeding of the larvae of the pandora moth on the foliage of pines. First, defoliation may be so severe as to result in loss of all the needles and finally cause the death of the trees, or, second, it may result in so weakening the trees that they fall easy prey to barkbeetle attacks.

Although many lodgepole pines have already been denuded of all their foliage as yet no mortality has been observed. In this connection Patterson in Oregon found that many severely defoliated ponderosa pine trees died two years after the defoliation took place. So it is entirely possible that some of the trees which were denuded of their foliage in 1937 may still die as a result of this damage. As yet no secondary insects or barkbeetles have been found attacking the defoliated trees on the Arapaho infestation, although in an adjacent area on Buffalo Creek an aggressive infestation of the Black Hills

beetle (Dendroctonus ponderosae Hopk.) occurred in lodgepole pine. This entire infestation of about 700 trees was treated during the winter of 1937-38.

The pandora larvae feed on the foliage of the lodgepole pine, consuming all of it, but do not eat the terminal buds; thus the trees are able to put out new needles. Because of this and the fact that severe defoliation even during epidemics occurs only every two years when the larvae are large, there is probably less mortality of the host trees than would otherwise occur.

One important economic loss which should not be overlooked is the suppression of the trees' growth during epidemic years. The width of annual rings sometimes becomes microscopic in size and during particularly severe defoliations some trees put on no annual ring at all.

When larvae are numerous all of the needles are eaten off the trees and they present a barren fire-swept appearance (Figs. 2 and 3). When defoliation is light the trees have a reddish-brown appearance. Extensive severe infestations show up as large brownish to gray areas (Fig. 4) depending on the amount of defoliation.

Extent of Infestation

As far as is known the present outbreaks of the pandora moth are confined to the lodgepole pine stands on the Arapaho National Forest

on the western slope of the Continental Divide. The largest infestation occurs on the Troublesome and Buffalo Creek drainages at elevations between 9,000 and 9,500 feet and covers an area of about six sections. One area, about a section in size, lies between the Troublesome and Timber Creeks and is located in Sections 29 and 30, T. 4 N., R. 78 W. The other area of about five sections in size lies in the Buffalo Creek drainage in Sections 32, 33, and 34, T. 4 N., R. 78 W., and in Sections 3, 4, 5, and 6, T. 3 N., R. 78 W. Another infestation occurs between Meadow Creek and Trail Creek about three miles north of Tabernash. This latter area is about twenty-five miles southeast of the Troublesome area and is possibly a half section in size. It lies in Sections 20 and 21, T. 1 N., R. 75 W. Although the above infestations are the only ones reported the forest has not been carefully examined for additional outbreaks and in all likelihood there are other infested areas which have not yet been reported. The forest should be examined this summer for the purpose of determining the character and extent of the pandora moth infestation.

General Observations

At the time the Arapaho outbreak was examined -- Aug. 10-15, 1937 -- some general observations were made which are listed here as a matter of record.

Only an occasional larva could be found, most of the insects occurring in the pupal stage. Feeding of the two-year old larvae had just been completed so the 1938 feeding of new larvae will be considerably lighter with 1939 being the next year of heavy feeding if the epidemic continues.

Pupae were very abundant in the bare, loose, well-decomposed granite soil and were less abundant in the duff and hard soil. Pupae (Fig. 1) were so thick it was possible to dig from 40 to 60 of them from two square feet of soil in the favorable spots which the larvae had selected for pupation.

While the insect is present over an extensive area severe defoliation as a result of its feeding occurs in only six or eight centers in each of which 40 to 80 acres of pure lodgepole pine timber have been almost completely denuded of foliage. These centers are confined almost entirely to the ridges and the damage is notably more severe on the southeastern exposures.

Sections of the boles of defoliated trees in one infestation center showed retarded growth for the last six years and in another center for the last three years. As yet no trees have died either from the effects of defoliation or from attack by other insects. However, there is grave danger of barkbeetles increasing in these areas and killing not only the defoliated trees but other trees as well.

Larval Mortality

The ground at the selected soft spots chosen for pupation was covered with the dead larvae (Fig. 5) which appeared to have been killed by the heat before they could dig into the soil or after they were pushed out of the soil by other larvae. They were dried and badly shriveled and little more than small, greasy balls -- the sun appearing to have fried large quantities of fat from their bodies. In spite of this loss of larvae the pupae are still extremely numerous.

Parasites

A large Dipterous parasite appears to be fairly abundant although its relative importance can only be obtained through rearing records. None have been reared yet and therefore no determination on its identity has been made.

Predators

It was evident from an examination of the area that squirrels and bears were destroying many of the pupae. Many large flat stones had been overturned and the pupae beneath them licked up by the bears. The squirrels had been digging small conical-shaped holes in the ground in search of pupae and judging from the number of holes they must have taken large numbers of them.

Disease

The caterpillars are subject to a wilt disease which has been said to be the most important single factor of control but we do not know yet whether it is present in any of these infestations or not.

Control

It seems probable that the pandora moth might be held in check during epidemics by spraying or dusting the infested trees with arsenicals. In July and August 1938 or other years when the caterpillars are small would be the best time to attempt control. While the second year larvae could undoubtedly be poisoned, better success would be expected in treating the first year larvae. Airplane dusting would be the most feasible plan of attack on this extensive area although the uncertainty of just how much additional damage may be done during the present outbreak throws considerable doubt on the advisability of attempting artificial control. If, for example, the outbreak has already reached its peak we can expect a natural decline during the next few years. In any event no control work should be attempted until a thorough survey of the general area has been made in order to locate other possible spots of infestation. Until further study can be made of the outbreak no definite data will be available

on insect survival, loss of trees, or need for control.

Respectfully submitted,

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Fig. 1

Pupae and prepupal larvae of the pandora moth dug from soil to show abundance. Insects present are only those from amount of surface soil shown.



Fig. 2

Lodgepole pine stands defoliated by
second year larvae of the pandora
moth.

Arapaho National Forest



Fig. 3

Lodgepole pine stands de-
foliated by larvae of the
pandora moth.

Arapaho National Forest.



Fig. 4

General view of one infestation center in lodgepole pine which has been defoliated by the pandora moth larvae on the Arapaho National Forest. Most severe damage shows up in the background.



Fig. 5

Dead larvae and pupae of the pandora moth on top of soil. Death and shriveling probably due to high surface soil temperatures.